

## **Remarks**

Claims 15 - 19 and 30 - 37 are pending. Favorable reconsideration is respectfully requested.

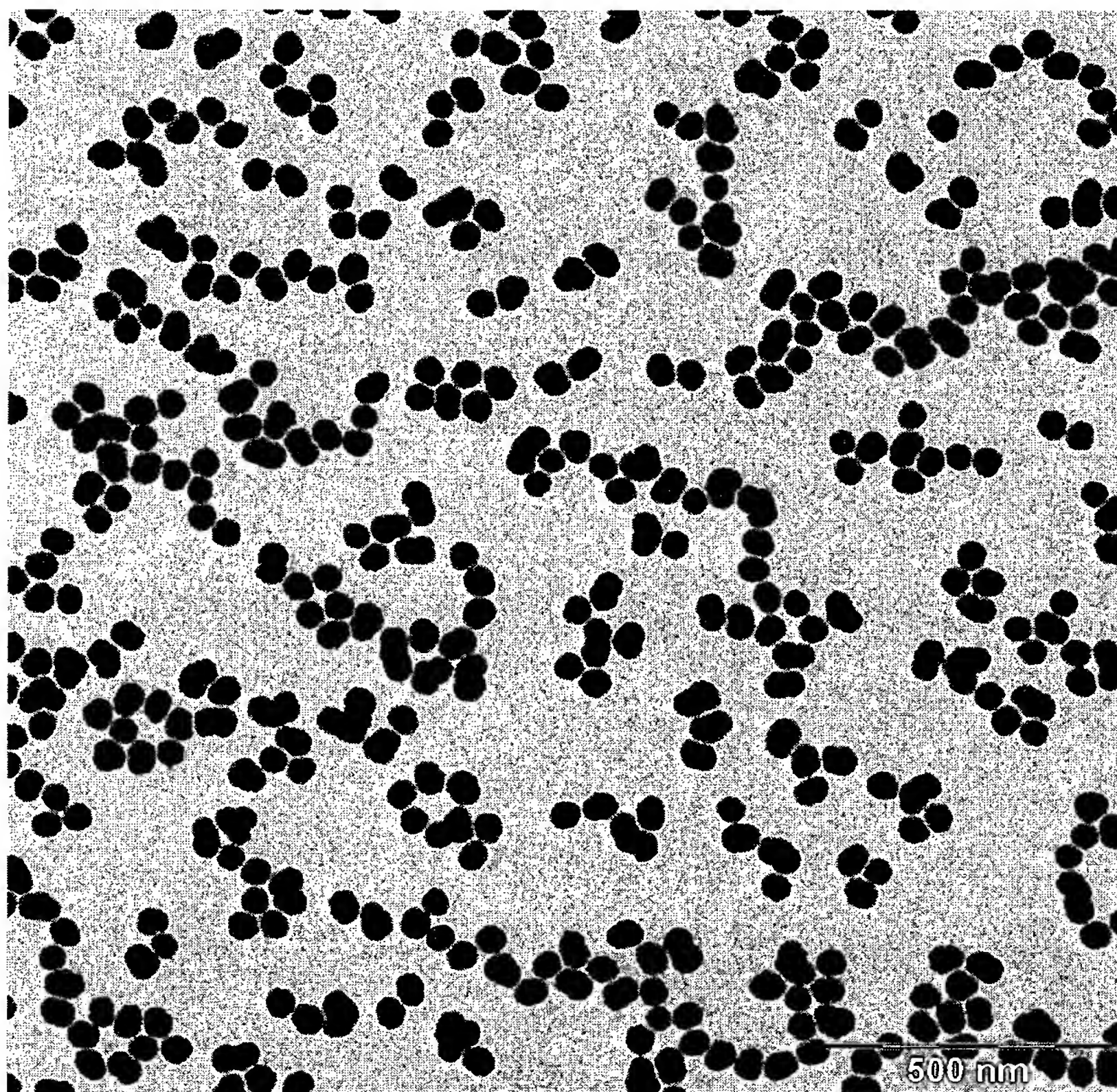
The claims have been rejected under 35 U.S.C. § 112 ¶1, and have been amended appropriately. The claims have been examined under the correct interpretation of the claims, no new issues are raised by this amendment, and the rejection was not formerly of record. Entry of the amendment is thus respectfully solicited, in particular as the amendment will reduce issues on appeal, should appeal be necessary.

Claims 15- 17, 19, and 30 - 36 have been rejected under 35 U.S.C. § 103(a) over Endo et al. JP 04298538 A ("*Endo*") in view of Fitzgerald et al. U.S. Patent No. 5,623,028 ("*Fitzgerald*") and Ward et al. U.S. Patent No. 5,573,189 ("*Ward*").

The subject invention is directed to special, partly hydrophobic silicas, which, despite being partially silylated, are still completely water wettable, and can be used in aqueous dispersions, for example aqueous dispersions containing dispersed curable resins such as epoxy resins.

*Endo* describes the use of wet process silica (colloidal silica) to increase the abrasion resistance and processing of at least uniaxially oriented polyester films. The silica is partly silylated, such that 30 - 70% of surface silanol groups are blocked. The silica is dispersed into the polyester during melt extrusion, or incorporated during the polymerization of the polyester raw ingredients, ethylene glycol and terphthalic acid.

The colloidal silica of *Endo* consists only of spherical particles, as is well known. See, *e.g.* R.K. Iler, THE CHEMISTRY OF SILICA, John Wiley & Sons, New York, 1979, the colloidal silica "Bible." A photomicrograph of colloidal silica appears below.

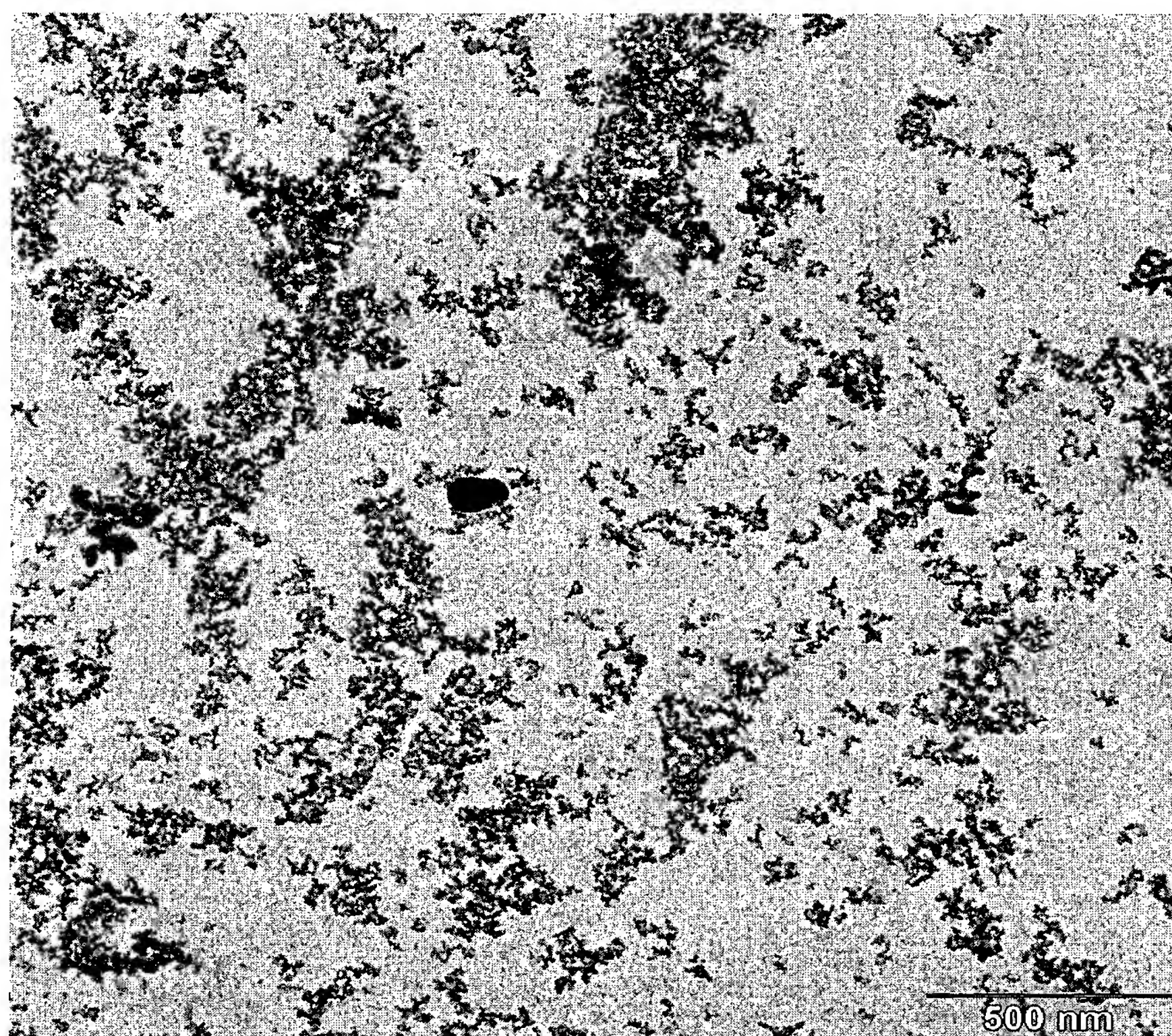


Note that the particles are all discrete, spherical particles. Despite the disclosure of *Endo* that the surface silanol content may be from 1 to 30 SiOH/nm<sup>2</sup>, this is clearly erroneous, as it is well known that colloidal silica has an SiOH content of from 4 - 5 SiOH/nm<sup>2</sup>. See, *e.g.* A.P. Le Grand, THE SURFACTANT PROPERTIES OF SILICAS, John Wiley & Sons, Chichester, 1998. At 70% blockage by silylating agents, colloidal silica will have a minimum residual silanol content of 2.8 SiOH/nm<sup>2</sup>.

*Fitzgerald* is not directed to the use of colloidal silica, but of fumed silica. Fumed silica is totally different chemical substances with respect to surface chemistry and morphology, as is well known.



Fumed, or pyrogenic silica, is formed at very high temperatures, 1500 - 1800°C by the flame hydrolysis of chlorosilanes in a hydrogen/oxygen flame. The initial primary particles of nm size which are formed, irreversibly fuse to irregular sinter-aggregates which are non-spherical, and thus totally different from the spherical particles used by *Endo*. A photomicrograph of fumed silica is shown below. The sinter aggregates are permanent - they cannot be broken apart, since they are fused together.



The fumed silica also has a low density of silanol groups, typically 2 - 2.5 SiOH/nm<sup>2</sup>, due to condensation of adjacent silanol groups to silicate or siloxy groups. The silanol groups of colloidal silica are associated silanol groups or germinal silanol groups, G.M.S. El Shafei, SURFACTANT SCI. SER. 2000, 90, 35, whereas the silanol groups of fumed silica are predominately isolated silanol groups.

Colloidal silica is stabilized in dispersion by electrostatic forces, and cannot be isolated as a dry powder without changing its properties, and is therefore supplied as a silica sol (aqueous or organic dispersion only). See, *Iler, id.* Any surface modification must be performed in suspension. Note, for example, [0013] of *Endo* which is an example of this surface modification. In this example, the surface silanol content of 8.0 SiOH/nm<sup>2</sup> was silylated in aqueous suspension to block 54.5% of surface silanol groups, leaving 3.64 SiOH/nm<sup>2</sup>.

*Fitzgerald*, unlike *Endo*, is not directed to colloidal silica, nor is *Fitzgerald* directed to preparing filled polyester thermoplastics. Rather, *Fitzgerald* is directed to the use of silylated fumed silicas for enhancing the recovery ("percent sealing force retention") in compounded elastomers. The silicas of *Endo* and the silicas of *Fitzgerald* are completely different, and the compositions to which *Endo* adds his colloidal silica and those to which *Fitzgerald* adds his fumed silica are completely different.

One skilled in the art, viewing *Endo*, would not be motivated to look to *Fitzgerald* for any purpose, and one so skilled, viewing *Fitzgerald*, would not be motivated to look to *Endo* for any purpose. How can these references be combined? Where is the motivation for their combination. If combined, what is the result?

It is well established that in a rejection based on a combination of references, the portions combined may not be simply "picked and chosen" without also incorporating all the salient features of the references. See, *e.g. In re Wesslau*, 148 U.S.P.Q. 391, 393 (CCPA 1965):

The ever present question in cases within the ambit of 35 U.S.C. § 103 is whether the subject matter as a whole would have been obvious to one of ordinary skill in the art following the teachings of the prior art at the time the invention was made. It is impermissible within the framework of section 103 to pick and choose from any one reference only so much of it as will support a given position, to the exclusion of other parts necessary to the full appreciation of what such reference fairly suggests to one of ordinary skill in the art.



A combination of *Endo* with *Fitzgerald* would result in the use of colloidal silica (*Endo*) with a high residual silanol content. That is not the claimed invention. One skilled in the art would not be motivated to combine these highly different references. *Endo* chooses to use spherical, colloidal silica particles to increase abrasion resistance in oriented polyester plastics. Fumed silica, with no spherical particles, would not be expected to function the same in *Endo's* invention. Not only is the particle morphology completely different: spherical versus highly irregular, and elongate, chain like, but upon orientation, the colloidal silica particles, being spherical, cannot orient themselves in the direction of stretch, while fumed silica particles can. Note that *Endo* cites other JP references which teach the use of other types of silicas in paragraph [0006], but indicates that these silicas do not work. *Endo* thus proposes a highly specialized silica, a colloidal silica with partial silylation. One would not be motivated, in view of the disclosure of *Endo*, to substitute a completely different silica, fumed silica, a silica different both chemically and physically, for *Endo's* carefully selected filler.

Moreover, neither *Endo* nor *Fitzgerald* teach or suggest a surface silanol content of 0.9 and 1.7 SiOH/nm<sup>2</sup>. This surface silanol content is necessary in Applicants' invention to secure stable dispersions, yet remain water wettable. *Endo* is not directed to water wettability. His colloidal silica is added to a hydrophobic polyester polymer, either during manufacture, or during processing. *Endo* does not teach or suggest such a low silanol content. In paragraph [0015], *Endo* indicates that if the starting SiOH content of the silica is too low, the silica cannot be dispersed, and thus cannot be silylated. *Endo* does not disclose, nor does he teach or suggest how a colloidal starting silica with any low range of silanol content can even be prepared, since colloidal silica is known (*Iler*) to have 4 - 5 SiOH/nm<sup>2</sup> minimum as silanol content.

*Fitzgerald* also does not teach a silanol content of 0.9 - 1.7 SiOH/nm<sup>2</sup>. *Fitzgerald* teaches a pyrogenic starting silica which is unlike that of Applicants, since his silica is prepared with a high water content, and has an unusually high silanol density of 4.5 SiOH/nm<sup>2</sup> even prior to slurring in water, and then silylated with relatively large quantities of hexamethyldisilazane. The lowest silanol density is 2.39 SiOH/nm<sup>2</sup> (Table 1), and this was achieved only through the use of 25 g of HMDZ per 100 g of silica, a commercially prohibitive amount (HMDZ is quite expensive). Applicants' silica is prepared under anhydrous conditions, and thus the starting silica

has the normal content of ca. 2 - 2.5 SiOH/nm<sup>2</sup>. That these silicas are completely different is shown by Example 3 of the subject invention, where HMDZ is also used for silylation, but in an amount of only 20 g/h per 1500 g/h of silica. The lowest density of silanol groups of any silica disclosed by *Fitzgerald* is 2.39 SiOH/nm<sup>2</sup>, and the silanol content ranges from 3.85 - 2.39 SiOH/nm<sup>2</sup>. There is no disclosure of the claimed range of 0.9 to 1.7 SiOH/nm<sup>2</sup>. The entire thrust of *Fitzgerald* is to adjust the silanol surface density within defined ranges. However, the range used by Applicants, which is for an entirely different purpose, is neither disclosed, taught, nor suggested.

*Ward* adds nothing to this rejection, only reciting that fumed silica having a surface area of 50 to 600 m<sup>2</sup>/g and an aggregate size of 0.20 to .35 microns should be used in his invention, which is directed to silica filled injection moldable polymers, fields different from both *Endo* and *Fitzgerald*. Once again, there is no motivation to combine this reference with either of the other references.

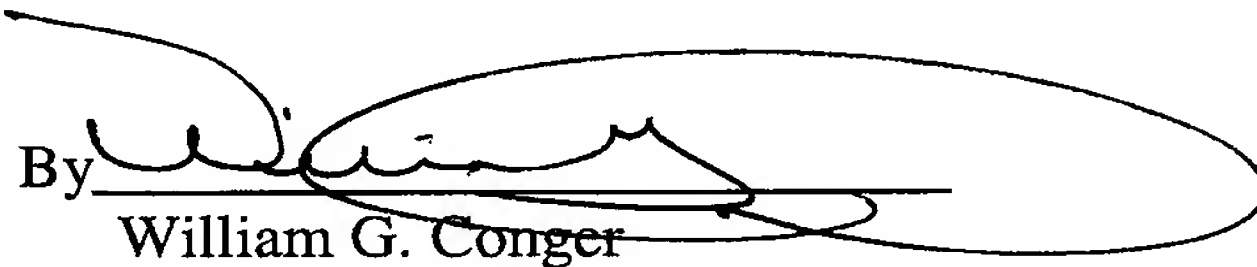
None of the references, whether alone or in combination, teach or suggest the claimed contact angle, density of silanol groups, or methanol number. None of the references, alone or in combination, teach the use of the claimed silicas in preparing aqueous dispersions. The problems addressed by the references and those addressed by the subject invention are completely different and unrelated. None of the references disclose using a fumed silica having Applicants' low silanol density, yet a density which allows for free dispersion in water. One would not be motivated to substitute fumed silica for *Endo's* colloidal silica, since these are do different chemically and physically.

Withdrawal of the rejection of the claims over *Endo* in view of *Fitzgerald* and *Ward* is respectfully solicited for all these reasons.

Please charge any fees or credit any overpayments as a result of the filing of this paper to our Deposit Account No. 02-3978.

Respectfully submitted,

**Torsten-Gottschalk-Gaudig et al.**

By 

William G. Conger

Reg. No. 31,209

Attorney/Agent for Applicant

Date: August 16, 2010

**BROOKS KUSHMAN P.C.**  
1000 Town Center, 22nd Floor  
Southfield, MI 48075-1238  
Phone: 248-358-4400  
Fax: 248-358-3351